

## *Eleiotis sororia* (L.) DC. (*Leguminosae*), New to Myanmar

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In the course of floristic research of Myanmar, we found *Eleiotis sororia* (L.) DC. as new to the flora. This is the easternmost end of distribution of this species. The nomenclatural confusion of this species is reviewed and the lectotype is designated here. Detailed illustrations of flower, fruit and seed are presented as well as their descriptions. Conspicuous indumentum in the inflorescence and anatomical features of the fruit with respect to the joint structure are described in detail.

**Key words:** *Desmodieae*, *Eleiotis sororia*, lectotype, *Leguminosae*, Myanmar, new record.

The genus *Eleiotis* DC. belongs to the tribe *Desmodieae* of subfamily *Papilionoideae* (*Leguminosae*) and comprises only two species, *E. sororia* (L.) DC. (or *E. monophyllos* (Burm. f.) DC.) and *E. rottleri* Wight & Arn. (Ohashi et al. 1981, Sanjappa 1992, Kumar and Sane 2003, Ohashi 2005). The former species has been known only from India and Sri Lanka (Sanjappa 1992, Pedley 1996, Kumar and Sane 2003), while the latter is recorded from India, Sri Lanka and Myanmar (Sanjappa 1992, Kumar and Sane 2003). Pedley (1996), however, did not agree with the occurrence of the latter species in Sri Lanka and also in Myanmar. Sanjappa (2001) later confined the distribution area of *Eleiotis* to Peninsular India and Sri Lanka. Kress et al. (2003) listed *Desmodium rottleri* Baker, a synonym of *E. rottleri* (Sanjappa 1992, Kumar and Sane 2003, International Legume Database

& Information Service (ILDIS)), in their checklist of the Myanmar flora. The occurrence of *E. rottleri* in Myanmar, therefore, appears to be still questionable at present.

During field expedition performed in the central to western Myanmar in November to December 2002, we found *Eleiotis sororia* (Fig. 1) near Seik Phyn Township between the Irrawaddy River and Saw Town (Fig. 2). After the expedition we found another specimen of the species collected in central Myanmar by the staff of Popa Mountain Park (Nature and Wildlife Conservation Division, Ministry of Forestry, Myanmar) (Fig. 2). These specimens indicate the first record of this species from Myanmar. Because the species was known only from India and Sri Lanka, these specimens extend the eastern limit of the distribution to Myanmar. At the locality near Seik Phyn Township

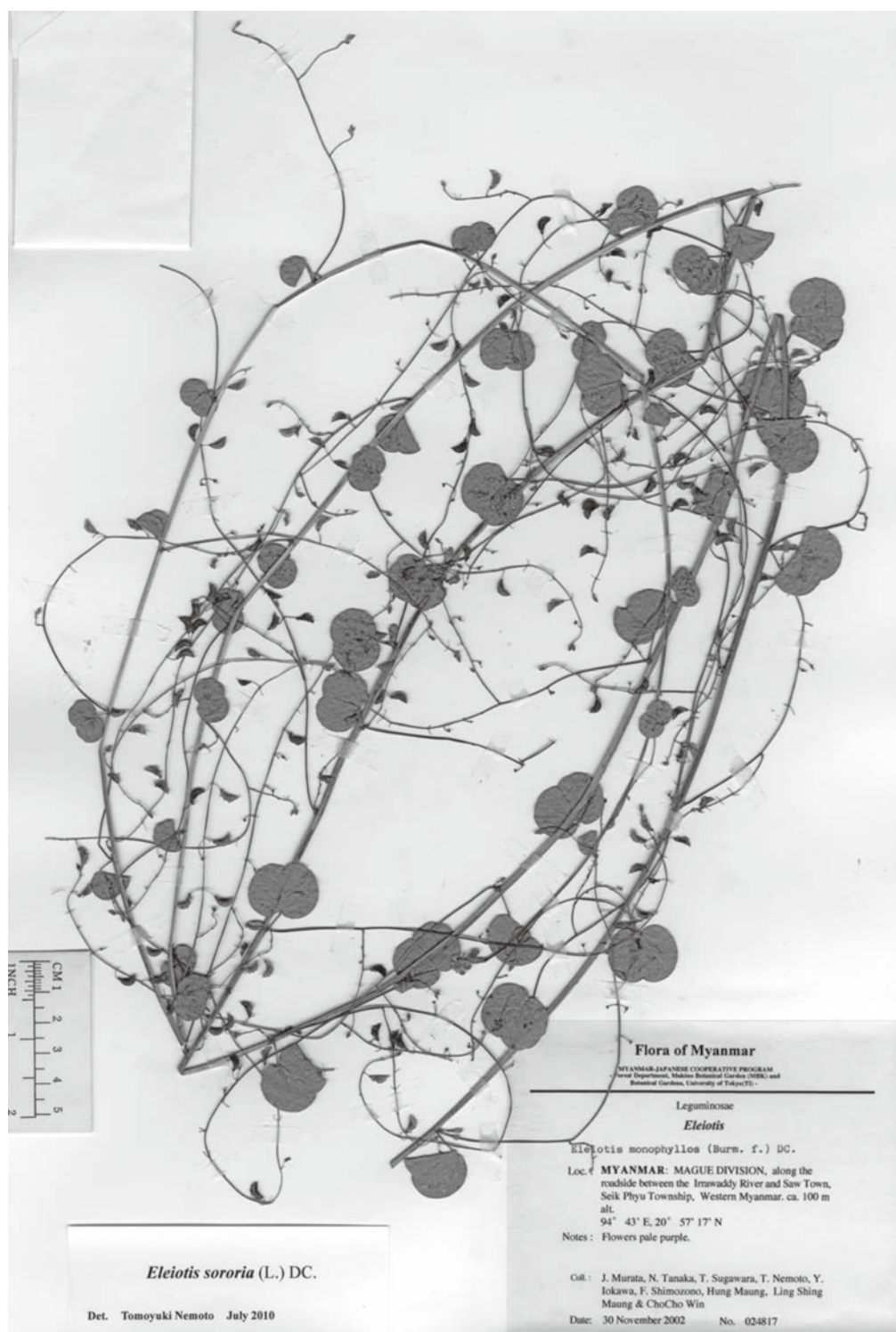


Fig. 1. *Eleiotis sororia* (L.) DC. collected from Myanmar, Mague Division, along the roadside between the Irrawaddy River and Saw Town, Seik Phyu Township, ca. 100 m alt., 20°57'17"N, 94°43'E, 30 Nov. 2002, J. Murata & al. 24817 (TUS).

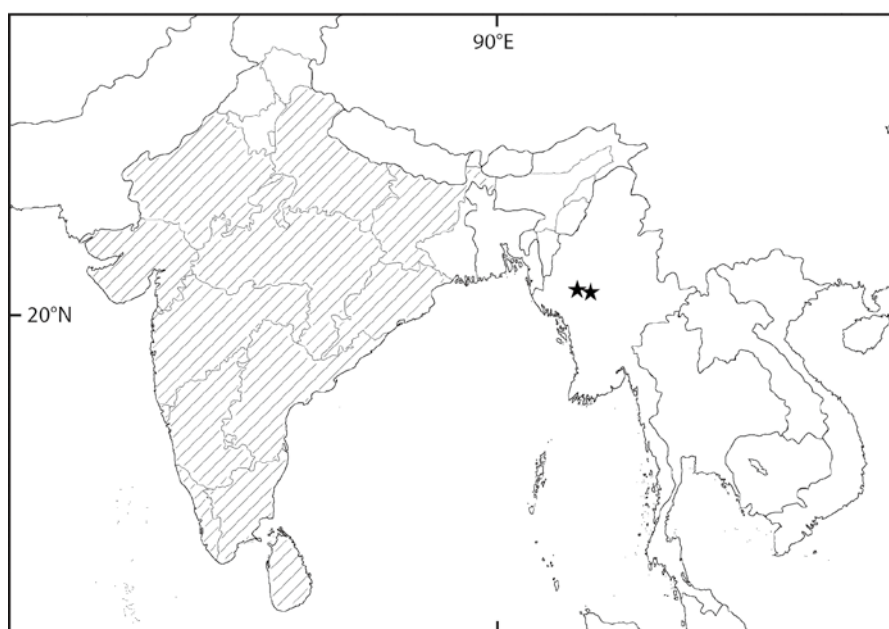


Fig. 2. Distribution map of *Eleiotis sororia* (L.) DC., showing states in India and Sri Lanka (hatched) cited in Kumar and Sane (2003) and two localities in Myanmar (★: left, J. Murata & al. 24817; right, T. T. Aye & K. M. Htwe 20701).

many individuals of *E. sororia* were grown in sandy and waste field and along sandy path surrounding the field.

The species is herb with prostrate stems. Stems and branchlets are three ribbed and slightly reddish. Leaves are mostly 1-foliolate but infrequently mixed with those bearing one or two significantly reduced lateral leaflets (Fig. 3) which were incorrectly regarded as stipules by Linnaeus (1771) (De Candolle 1826). The terminal leaflet represents characteristic reniform-orbicular shape emarginated at both ends, while the reduced lateral ones narrowly obtriangular or narrowly elliptic. The terminal leaflet is obviously petiolate when the lateral leaflets are completely reduced. When the reduced small lateral leaflets are borne, on the other hand, they are at the base of the petiole and just above the pulvinus with a small stipel at each base, and, therefore, the petiole becomes the leaf rachis and only the pulvinus becomes the petiole (Fig. 3B, C).

*Eleiotis sororia* (Figs. 3, 4) and *E. rottleri*

(cf. illustration cited in Ohashi (2005)) are distinguished from each other by leaf division (mostly 1-foliolate or with considerably smaller lateral leaflets vs. obviously and constantly 3-foliolate), terminal leaflets (reniform-broadly elliptic and emarginate both ends vs. obovate and emarginate at the top, acuminate or cuneate at the base), the rachis of the terminal leaflet (absent when 1-foliolate or longer than the petiole when reduced small lateral leaflets borne vs. always shorter than the petiole), calyx lobes (transversely triangular or transversely-narrowly triangular vs. triangular or broadly triangular), and pods (1-articulated and 1-seeded, short hooked hairs or glabrous vs. 1-articulated and 1-seeded or 2-articulated and two-seeded, pubescent).

With respect to the name of *Eleiotis sororia*, there has been some confusion about two names, *E. sororia* and *E. monophyllos* (or *E. monophylla*). Burman (1768) described this species for the first time under *Glycine* as *G. monophyllos* (with the feminine ending *-os*) presenting an illustration of the habit and whole

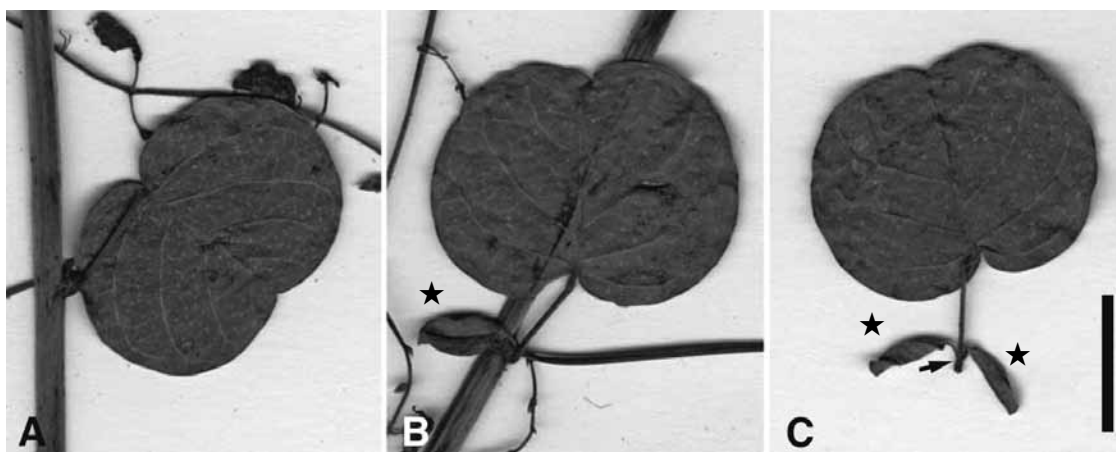


Fig. 3. Leaf variation in *Eleiotis sororia* (L.) DC. A. 1-foliate leaf. B. Leaf with one reduced lateral leaflet (★). C. 3-foliate leaf with two reduced lateral leaflets (★) which are borne at the base of the petiole and just above the pulvinus (arrow). Voucher: J. Murata et al. 24817 (TUS). Scale bar = 1 cm.

morphology. Subsequently, Linnaeus (1771) published *Hedysarum sororium* citing Burman's *G. monophyllos* as the replaced synonym. *Hedysarum sororium* L. was followed by Roxburg (1832), and then the epithet has been adopted under the genera *Hallia* (Willdenow 1803), *Onobrychis* (Desvaux 1814), or *Eleiotis* (De Candolle 1825, 1826, Wight and Arnott 1834, Baker 1876, and al.). When De Candolle (1825) established the new genus *Eleiotis* distinguishing from *Glycine*, *Hedysarum*, *Hallia* and *Onobrychis*, he recognized two species, *E. monophylla* (Burm.f.) DC. (changing Burman's original ending to the Latin feminine ending -a) and *E. sororia* (L.) DC, based on whether leaves are 1- or 3-foliate with hesitation in the separation at the rank of species. The name *E. monophylla* has resulted in later confusion about two spelling of this species, *E. monophyllos* and *E. monophylla*. However, Wight and Arnott (1834) regarded both species as conspecific and accepted the name *E. sororia* (L.) DC. because both 1-foliate and reduced 3-foliate leaves are borne on the same individual, and they simultaneously described a new species, *E. rottleri* Wight & Arn. that has perfect 3-foliate leaves. *Eleiotis sororia* has been accepted by

many subsequent authors.

Merrill (1921) and Jarvis (2007), however, regarded the name *Hedysarum sororium* published by Linnaeus (1771) as illegitimate because Burman's *Glycine monophyllos* has priority and the epithet should be retained for the species. Many recent works, except Sanjappa (2001) in which *E. sororia* was accepted, have accepted *E. monophyllos* (Brum. f.) DC. (Pedley 1996, Kumar and Sane 2003, Jarvis 2007, ILDIS) or *E. monophylla* (Burm.f.) DC.) (Sanjappa 1992). Stearn (1992) explains that an adjectival epithet published with a Greek ending should keep in agreement with the gender of the generic name with which it is associated, and the Greek ending is not against the International Code of Botanical Nomenclature (McNeill & al. 2006) (Art. 23 and Art. 60). In this case the correct spelling should be *E. monophyllos*. De Candolle's spelling *E. monophylla* was an unnecessary change.

During the examination of this species for the present study, we found an earlier homonym *Glycine monophylla* L. published in 1767 (Syst. Nat. ed. 12. 2: 484; Mant. Pl. 101 (as "monophyllum")) (Jarvis 2007). This plant was transferred to *Hallia* as *Hallia monophylla* (L.)

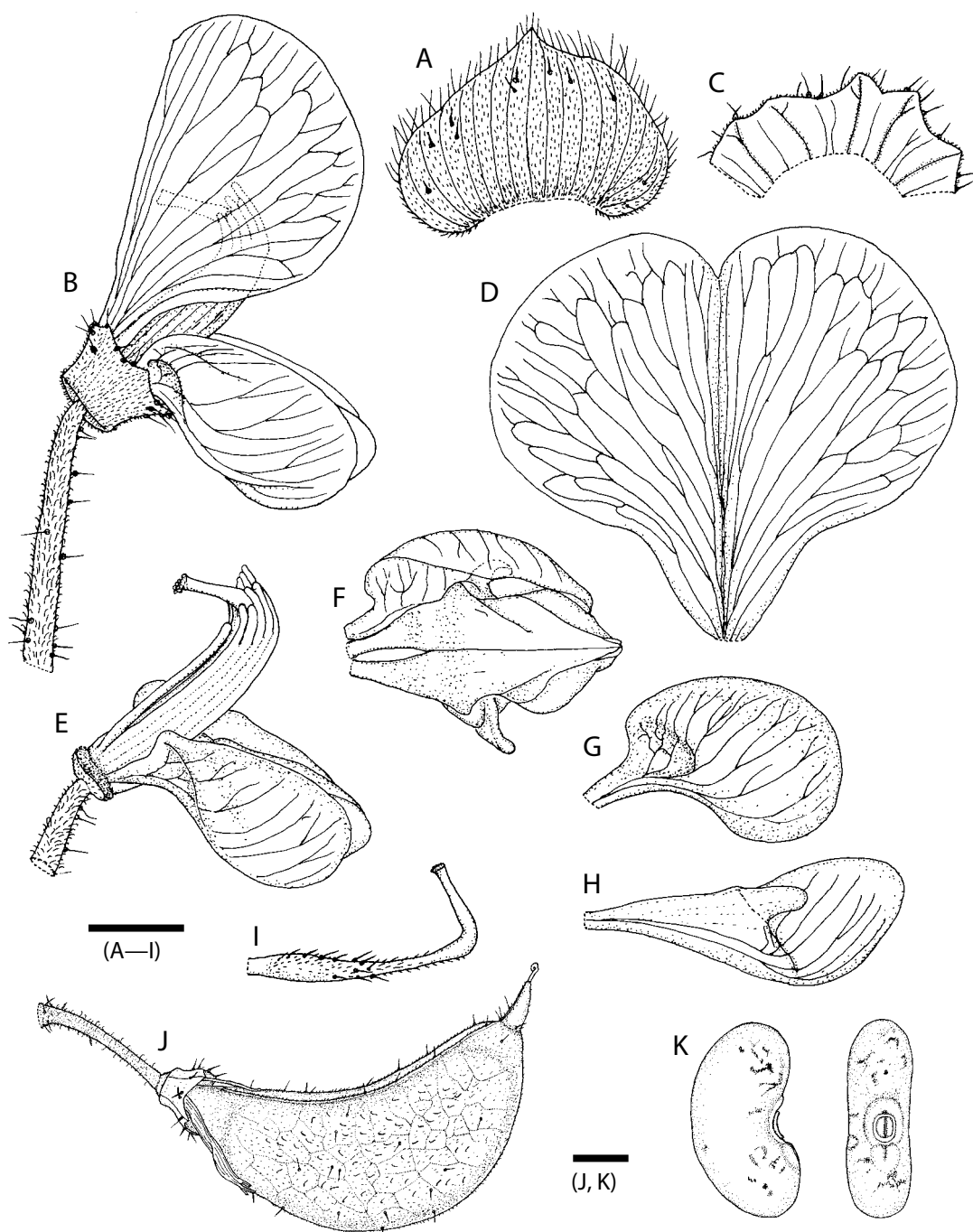


Fig. 4. Flower, fruit and seed of *Eleiotis sororia* (L.) DC. A. Bract subtending two flowers. B. Flower after explosive activation, showing wings and keel-petals reflexed downward. C. Calyx dissected, showing the inside. D. Standard. E. Flower removed standard, showing diadelphous androecium, the anthers of which have already fall down by explosion. F. Wing and keel-petals (inside view), showing keel-petals connate distally along the lower margin and their lateral protuberances projecting into and adnate to the inside of the wings. G. Wing. H. Keel-petal. I. Gynoeceum. J. Pod. K. Seed (lateral and hilar views). Voucher: J. Murata & al. 24817 (TUS). Scale bars = 1 mm.

Schindl. (1926), or to *Psoralea* as *P. monophylla* (L.) C.H.Stirt. (1984), and the latter is the current name (Jarvis 2007). *Glycine monophyllos* Burm. f. (1768) is obviously the later homonym and, therefore, illegitimate. Although Merrill (1921) and Jarvis (2007) regarded it as illegitimate, we should consider the publication of *Hedysarum sororium* by Linnaeus (1771) as his proposal of a new name for the plant under *Hedysarum* and treat Burman's name as the replaced synonym. As mentioned above, De Candolle (1825, 1826) distinguished two species, *E. monophyllos* (Burm.f.) DC. (as *E. monophylla*) and *E. sororia* (L.) DC., based on leaflet numbers. When they regarded both species as conspecific, Wight and Arnott (1834) accepted the latter name. It seems likely that they noticed the problem of the basionym of *E. monophyllos* (Burm.f.) DC.

According to the online Linnean Collections repository of the Linnean Society of London, we can find a specimen (Herb. Linn. No. 921.9, LINN) identified as *Hedysarum sororium* with Linnaeus's script "*Sororium*". This specimen has 1-foliolate leaves and also (2-)3-foliolate ones with reduced small lateral leaflets that were incorrectly regarded as stipules in the diagnosis by Linnaeus (1771) (De Candolle 1826). The specimen would be original material for *H. sororium*. The specimens collected from Myanmar also represent reduced (2-)3-foliolate leaves as well as 1-foliolate ones on the same individual (Fig. 3), and the reduced 3-foliolate leaves are obviously insignificant as a distinguishing characteristic in agreement with the treatment on Indian plants by Wight and Arnott (1834). Thus, we regard both Myanmar and Indian plants as the same species and accept the name *Eleiotis sororia* (L.) DC. for these in the present study. Because the type of this name, or the basionym, has not yet been designated (Jarvis 2007), we here designated the specimen (Herb. Linn. No. 921.9, LINN) as the lectotype.

When we collected the specimens in Myanmar, it was the ideal season for flowers and fruits. The flower of *E. sororia* was confirmed

to be an explosive type (Fig. 4B, E). This type of flower is one of representative characteristics of the members of the "Desmodium group" recognized in the tribe *Desmodieae* based on *rbcL* data, although the placement of *Eleiotis* in the group was regarded as still uncertain since not analysed for *rbcL* (Ohashi 2005). Moreover, we found that the keel-petal has a conspicuous protuberance near the base of the lamina (Fig. 4F, H) and that there are remarkable bulbous glandular hairs together with hooked ones in inflorescences, flowers and pods (Fig. 5A, B, I, J).

The 1-articulated and 1-seeded pod of *E. sororia* was described as 1-jointed (Roxburg 1832), 1-jointed with joints slightly bluntish at both ends (Wight and Arnott 1834), or only as jointed (Baker 1876). The present anatomical observation revealed the article with joints on both distal and proximal ends (Fig. 5B, C, D). Because of the 1-seeded pods, Hutchinson (1964) attributed *Eleiotis* to tribe *Lespedezieae* before. But the 1-seeded pod of *Lespedeza* has a joint only at the proximal end of the article (Nemoto and Aida 2008). The proximal joints were described as "Type C" in both *Eleiotis* and *Lespedeza* by Nemoto and Ohashi (2003). The type is characterized by the thickened sclerenchyma around the joint and undifferentiated parenchymatous tissues inserted into the sclerenchyma (Fig. 5B, C). The inserted parenchymatous tissues result into structural weakness at the joint. Here we confirmed the similar structure present also in the distal joint in *E. sororia* (Fig. 5D).

***Eleiotis sororia*** (L.) DC., Prodr. 2: 348 (1825), Mem. Legum. 6: 350 (1826); Wight & Arnott, Prodr. Fl. Pen. Ind. Ori. 231 (1834); Baker in Hook. f., Fl. Br. Ind. 2: 153 (1876); Cooke, Fl. Pres. Bombay 1(2), 342 (1902); Prain, Bengal Pl. 1, 300 (1903); Gamble, Fl. Pres. Madras 333 (1918).

*Glycine monophyllos* Burm. f., Fl. Ind. 161, t. 50, f. 2 (1768), nom. illeg.; non *G. monophylla*

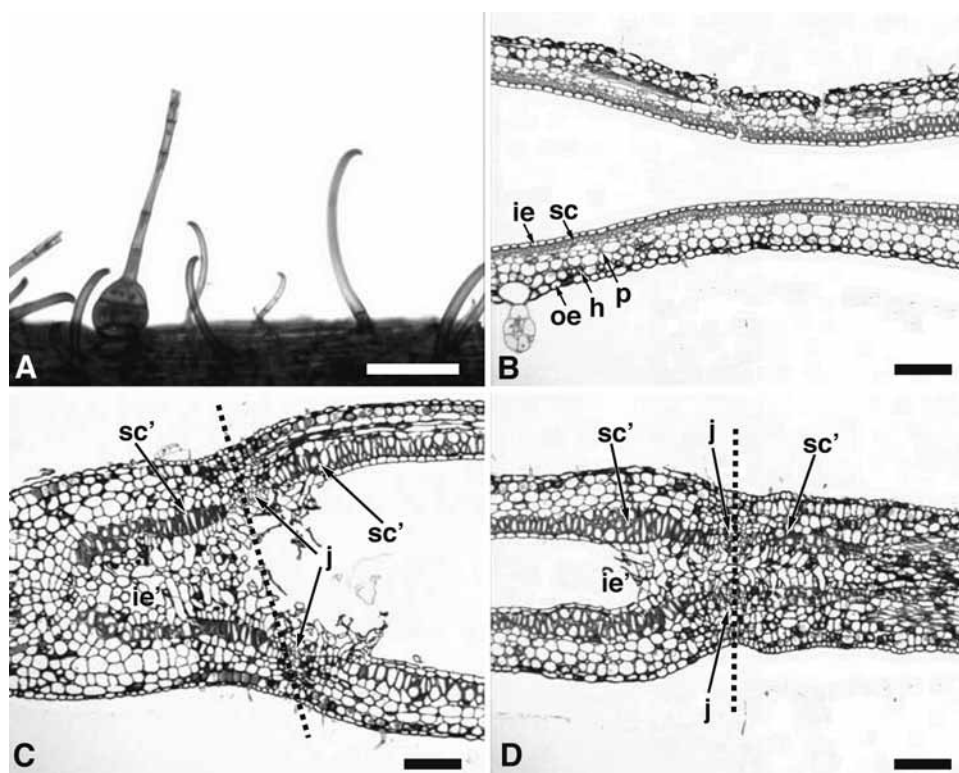


Fig. 5. Indumentum of inflorescence (A) and fruit anatomy (B–D) in *Eleiotis sororia* (L.) DC. A. Bulbous multicellular gland and hooked hairs in inflorescence, stained with Toluisin Blue O. B–D. Longisections of pod, made from material fixed in FAA, embedded in a metacrylate resin (Technovit 7100) after dehydration through an ethanol series, sectioned at a thickness of 2  $\mu$ m, and then stained with Toluidine Blue O. B. Pericarp near the part facing seed (removed), showing stratification of the tissue: outer epidermis (oe, one-cell thick), hypodermis (h, one-cell thick), parenchyma (p, three-cell thick), sclerenchyma (sc, one- or two-cell thick) and inner epidermis (ie, one-cell thick). The left is near the central part of article, and the right near the distal end of article, showing the sclerenchyma becomes thicker toward the distal end. C. Pericarp in proximal joint region, showing thickened sclerenchyma (sc'). Some cells of inner epidermis (ie') on opposite sides of the pericarp adhere to each other. A broken line indicates the easily broken plane at the joint, where parenchymatous tissues (j) are inserted into the thickened sclerenchyma (sc'). D. Pericarp in distal joint region, showing thickened sclerenchyma (sc') inserted by parenchymatous tissues (j) and adhered inner epidermis (ie') as the proximal joint. Voucher: J. Murata & al. 24817 (TUS). Scale bars = 100  $\mu$ m.

L. Syst. Nat. ed. 12. 2: 484 (1767); Mant. Pl. 101 (1767), ut *G. monophyllum*.

*Hedysarum sororium* L., Mant. Pl. Alt. 270 (1771). **Lectotype:** Herb. Linn. Herb. Linn. No. 921.9 (LINN) (designated here)]; Roxb. Fl. Ind. Ed. 2, III, 352 (1832) & Icones Roxb. 396, ut *Hedysarum sororium* Willd.

*Hallia sororium* (L.) Willd., Sp. Pl. 3(2), 1170 (1802); Sprengel, Syst. Veg. 3, 195 (1826).

*Onobrychis sororia* Desv. in J. Bot. 3, 80

(1814).

*Eleiotis monophyllos* (Burm. f.) DC., Prodr. 2: 348 (1825), ut *E. monophylla*, Mem. Legum. 350 (1826); Merrill in Philipp. J. Sci. 19: 357 (1921), ut *E. monophylla*; Sanjappa, Leg. India 171 (1992), ut *E. monophylla*; Pedley in Rev. Handb. Fl. Ceylon 10: 159 (1996); Kumar & Sane, Leg. S. Asia 209 (2003); Jarvis, Order Chaos 562 (2007).

Prostrate herb with stems to more than 2



m long, 3-ridged, glabrous except distal end with appressed short hairs on ridges, slightly reddish. Leaves alternate, stipulate, petiolate, mostly 1-foliate, infrequently (2–)3-foliate with (1–)2 reduced lateral leaflets just above pulvinus. Stipules almost persistent, triangular to broadly triangular or broadly ovate, striate,  $2-3 \times 1.2-2.5$  mm, glabrous. Petioles 5–21 mm long in 1-foliate leaves, glabrous or sparsely appressed-pubescent; pulvini 0.8–2 mm long, sparsely appressed-pubescent. Terminal leaflets reniform,  $8-26 \times 10-33$  mm, cordate at base, emarginated at apex, glabrous above, sparsely appressed-pubescent beneath; pulvinules 0.8–2 mm long, appressed-pubescent, with two stipels (0.7–1 mm long, narrowly triangular) at base. Lateral leaflets, if present, obovate or elliptic,  $4.5-7 \times 2-3.2$  mm; pulvinules 1.7–2 mm long, appressed-pubescent, with stipel minute (ca. 0.2 mm long, triangular) at the base. Inflorescences axillary, slender pseudoracemes or compound pseudoracemes with lateral branches from lower nodes, up to 16 cm; flowers in 2-flowered fascicles per node, nodes 8–14 per inflorescence; peduncles up to 5 cm; the rachis and pedicels with spreading hooked hairs composed of two cells, a short basal cell and a larger terminal cell bent into the form of a hook, mixed with bulbous glandular hairs composed of globose or ovoid glandular group of cells and a terminal, tubular, blunt hair consisting of one or two rows of cells (Fig. 5A). Primary bracts transversely depressed ovate, sparsely appressed-pubescent mixed with bulbous glandular hairs on outside, ciliate,  $1.8-2.5 \times$  ca. 2.9 mm, flower bearing ones caducous, subtending 2-flowered fascicle, while those subtending lateral rachis at the proximal portion persistent; secondary bracts absent. Pedicels 1.5–3 mm long in flowers. Bracteoles absent. Flowers explosively activated, ca. 8.5 mm long. Calyx broadly campanulate, ca. 0.8 mm long, appressed-pubescent mixed with bulbous glandular hairs outside, ciliate, 4-lobed; lobes distinctly shorter than the tube, upper lobe minutely 2-toothed at the apex,

lateral and lower lobes transversely triangular or transversely-narrowly triangular. Corolla pale purple; standard broadly or transversely-broadly obovate, cuneate to the base, ca.  $4.3 \times$  ca. 4.9 mm, distinctly longer than wings and keel-petals; wings ca.  $2.7 \times$  ca. 1.8 mm, outcurved slightly towards the apex, rounded at the apex, oblique at the base, with slight protuberance at the base of the lamina, the claw ca. 0.6 mm long; keel-petals longer than the wings, ca.  $3.4 \times$  ca. 1.4 mm, incurved slightly toward the apex, obtuse at the apex, tapering to a claw, the claw ca. 0.9 mm long, with bell-shaped protuberance at the base of the lamina. Androecium ca. 2.5 mm long, diadelphous. Floral nectary absent at the base of the inside of staminal tube. Gynoecium ca. 3.3 mm long including the style of ca. 0.1 mm long, clothed with appressed minute hairs and bulbous glandular hairs on the ovary and the base of the style, the style incurved at a right angle, slightly thickened at the corner. Pods boat-shaped, apiculate at the apex with the remnant of style and stigma,  $5.5-6.2$  (excluding the remnant)  $\times$   $2.3-2.5$  mm, short-stiped (stipes ca. 0.4 mm), pale green to pale purplish when young and dark brownish when mature, incurved slightly toward the apex, 1-articulated and 1-seeded, upper suture thickened, indehiscent, pedicels up to ca. 3.5 mm long; the article with joints at both ends, covered with minute hooked hairs and bulbous glandular hairs, glabrous when ripe, reticulate-veined. Seeds transversely-broadly elliptic, ca.  $3.7 \times$  ca. 1.7 mm, hilum ca.  $0.5 \times$  ca. 0.4 mm.

Specimens collected: **Myanmar**. Mague Division, along the roadside between the Irrawaddy River and Saw Town, Seik Phyn Township, Western Myanmar, ca. 100 m alt.,  $20^{\circ}57'17''\text{N}$ ,  $94^{\circ}43'\text{E}$ , flowers purple, 30 Nov. 2002, J. Murata & al. 24817 (MAK, RAF, TI, TUS); Mandalay Division, along roadside between Popa Lwin village and Chine village, Popa Mountain Park, Kyaukpadaung Township, Central Myanmar, 18 Aug. 2000, T. T. Aye & K. M. Htwe 20701 (MAK, TI).

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根本智行<sup>a,\*</sup>, 五百川 裕<sup>b</sup>, 邑田 仁<sup>c</sup>: マメ科 *Eleiotis sororia* (L.) DC. のミャンマー新記録

マメ科ヌスビトハギ連 *Eleiotis* は, *E. sororia* (L.) DC. と *E. rottleri* Wight & Arn. の2種のみからなる。*E. rottleri* はインド (カルナータカ州, マハーラーシュトラ州), スリランカおよびミャンマーに分布することが知られているが, *E. sororia* は, これまでインドのアーンドラ・プラデーシュ, ビハール, ゴア, グジャラート, カルナータカ, ケーララ, マディヤ・プラデーシュ, マハーラーシュトラ, オリッサ, ポンディシェリー, ラージャスターン, タミル・ナードゥ, ウッタル・プラデーシュの各州, およびスリランカに分布することが知られていた。今回, ミャンマー中・西部で *E. sororia* の生育が確認されたことから, 本種の分布域の東限はインドからミャンマーに拡張された。

また, 本種の学名に関して従来混乱があったので, これらを再検討し, 整理した。さらに, *Eleiotis sororia* のタイプが未指定であったため, 基礎異名 *Hedysarum sororium* L. にさかのぼりレクトタイプを指定した。

本種は側小葉の有無に同一個体内で変異のあることが知られていたが, ミャンマー産のものでも同様の変異が確認された。また, 花は爆裂花であることが判明し, *rbcL* に基づいてヌスビトハギ連内に識別された *Desmodium* グループに帰属する属と共通の特徴をもつことが示唆された。その他, 竜骨弁に突起が生じること, 花序, がく, 果実に鉤毛の他に基部が丸く膨らむ多細胞の腺毛が目立つことなどの特徴を有していることがわかった。さらに, 果実は1小節果で1種子のみをつけるが, 小節果の両端に折れやすい節が発達することがわかった。果皮全体にわたり内表皮のすぐ内側に厚壁組織が形成されるが, どちらの節も節周辺で厚壁組織層が厚くなるものの, 節部では部分的に厚壁組織が発達せず柔組織のままとなるため構造的に弱く折れやすくなる。

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